PRACTICE ON NAVIGATION, RELATED SENSORS AND MEASURING SYSTEMS

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In the field of navigation the estimation of inertial sensor deterministic errors plays a key role. Mainly multi-axial non-orthogonalities/misalignment and scale factor errors have to be identified and estimated within a calibration process and then compensated. There exist many approaches to calibrate inertial sensors (see Fig. 1&2); however, their applicability is strongly influenced by the time consumption and by the equipment used for the calibration. These two factors mainly affect the price which is the factor all manufactures consider the most. According to required precision and price a method is determined and applied. As much as deterministic error model is supposed to be known before the navigation takes place, stochastic parameters of inertial sensors need to be studied and modeled. A usual way to do so is via so called Allan Variance Analysis. This method is capable of distinguishing types of sensor inner errors sources based on their time-domain characteristics.

The practice will cover practical Matlab coding to perform the calibration of an inertial measurement unit to get into the basic principles of deterministic errors present in inertial sensor triads as well as the practice will provide a practical knowledge with the Allan Variance Analysis. All coding will use codes and data already prepared.

Fig. 1 – A calibration platform (left), a quartz accelerometer and fiber optic gyroscope (right)

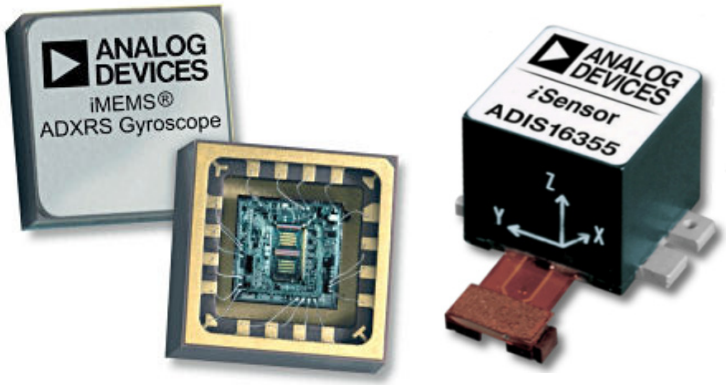

Fig. 2 – Analog Devices gyroscope (left), IMU (right)